Public knowledge-making and the media: genes, genetics, cloning and mass observation

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Public knowledge-making and the media: genes, genetics, cloning and Mass Observation

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Introduction

Public knowledge about genetics and genomics is often framed as shallow, reactionary or just uninformed by stakeholder advocates for particular innovations in application or policy. Media representations are regularly characterized by scientists as exaggeration or fear-mongering and the general public's scientific knowledge is often characterized as slightly ridiculous. Against this general context, work on public engagement is often pursued to contest the assertion that there has been an historical distrust of science, and that there is currently an 'anti-science brigade', despite decades of work by social scientists demonstrating the contextual character of the 'public understanding of science' (Wynne 1992, Irwin and Michael 2003). The figure of the 'anti-science brigade' was frequently mobilised by the UK Prime Minister Tony Blair during his time in office (1997-2007) through repeated references to 'irrational' public debate against which science needed to be defended (Haran *et al* 2008).

The research findings presented here, however, are in tune with what Irwin and Michael call the 'ethnographic turn' in public understanding of science (2003: 28) which observes that: 'people do not simply possess *knowledge* about scientific "facts" and scientific procedures and processes, they can also reflect upon the epistemological status of that knowledge' (Michael 1996: 107). What is distinctive about the research is that it invited respondents to characterise and reflect upon the sources of their knowledge about genetics and genomics – areas of science which have been the subject of an exceptional degree of public discourse in the late twentieth and early twenty-first centuries – in a relatively open-ended way, without directing them to particular examples of genetic knowledge dissemination.

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Recent research into public engagement with genetics can be characterized in terms of three approaches: attitudes studies (Sturgis et al 2005, Condit, 2010); media content analysis (Kitzinger 2008, Nerlich et al 2002); and patient or focus group work (Kerr and Cunningham-Burley 2000, Franklin and Roberts, 2004). All three approaches draw researchers' attention to immediately current time frames. Some use media examples as a resource for eliciting and constructing respondents' attitudes, while others engage respondents in media making. Media content analysis and focus group work usually revolves around a specific issue (e.g. new technology, patient group, gene discovery, disease) media example, or a particular genre (news). All of these approaches draw attention to the currency of genetics and of media, both of which are cast (and re-cast) as immediate or emerging technologies at different points in time.

The following analysis makes an intervention in this area by reporting on a range of claims about how people know about genes, genetics and cloning. It demonstrates that people engage with media culture longitudinally, not simply in the moment, and use this in relation to their own experience to make knowledge; for example, about genetics. The research instrument used is one that elicits detailed written responses in a diary or letter type format. This enabled a map of a rich and detailed media culture to emerge in response to the question, as well as providing further evidence about people's dispositions towards genes, genetics and cloning. The archive of responses demonstrates the ways in which knowing about these scientific areas is negotiated through media resources and experience. It also demonstrates how different approaches to the question of the public and to the question of scientific knowledge are inhabited and performed by respondents. This project was conducted on the cusp of key changes and convergences in new and social media and hence offers insight into a changing media environment, whilst also emphasising the importance of understanding media cultures as playing out over time.

Method and approach: the Mass Observation Project

In 2006 we commissioned a *Mass Observation* (MO) directive called Genes, Genetics and Cloning. This article presents some of the detail of this research into what and how people know about genes, genetics and cloning in the UK. We provide an account of our methodology to draw attention to the challenges entailed in undertaking this analysis. We give a summary of the results of the directive in terms of the range of media that inform people's understanding of these areas, and we identify a range of dispositions towards genes, genetics and cloning. We analyse the way respondents draw on media discourses in critical and creative ways to arrive at their understandings of science. thus providing an account of public knowledge-making about

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science. The article also explores the patterns and textures of the responses in relation to debates in the field of public engagement with science.

The *Mass Observation* Project is a very specific kind of research instrument with distinctive features (Hubble, 2010). The project directors work with researchers to send out specific directives and ask their standing panel of observers to write back in relation to these. Such specific commissioned directives (like ours) are also mixed up with regular directives from the project. The project sends out three directives a year asking about observations of everyday life in Britain. Partly because *Mass Observation* has a historical presence in British culture, now made visible through media projects such as *Housewife 49*, and partly because it is a longitudinal project, respondents have a keen sense of the specificity of the project and their responsibility to it. That is to say that being a contemporary *Mass Observation* respondent provides something of an identity. The contemporary project is a re-launch of an older Mass Observation project conducted between 1937 and 1949. The practice of writing for an archive over time, and of entering into an agreement to do so, generates a sense of participation and ownership. This participation has a civic dimension. It entails making a 'science of ourselves' (Moran, 2007), in diary writing, in contributing to knowledge about the social world and to history. To write to the archive is to address the future and to carve out a place in the making of knowledge.

In choosing to use the Mass Observation infrastructure, which had a standing panel of 400 correspondents at the time of our directive, we knew we would not gain access to a statistically representative cross-section of the public. We hoped instead that we would be able to develop an understanding of what a small, socially engaged fraction of the UK population knew, believed and felt about contemporary developments in genomics, and perhaps of how they had come to form those knowledges, beliefs and feelings. We hoped to be able to contribute to something of a gap in the field by eliciting discussion in an open way that did not constrain the responses through a focus on particular media genres, issues, or patient groups, or through assuming particular criteria about what constitutes appropriate knowledge in the genomics or cloning field.

However, there were other constraints in using the MO directive. Its archivists have developed their own approach to questioning developed from their experience of commissioning directives. Hence, we entered into a dialogic process, involving our production of a set of questions and then subjecting them to the scrutiny of the MO archivists. This exchange highlighted both the

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specific modes used by the MO and the challenges researchers face when they attempt to investigate public understandings of science, without imposing their own framings. In our case, instead of using our suggested overview paragraph of the terrain we hoped to map, a teaser headline and a few sentences were substituted to produce a punchier and more appealing impression to make MO writers feel that they had something to say. In the process, some of the topics were reframed as bullet points to which a response was invited much more directly (indeed directively). The teaser headline constituted a challenge for us as media researchers. It read: "Dolly the Sheep, a human ear grown on a mouse, designer babies …". As we were interested in the interface of genomics with new reproductive technologies, the first and last terms were relevant, although the phrase 'designer babies' indicates controversy and moral judgement and is not simply a reference to a news event, such as the birth of Dolly the sheep. In addition, we were anxious that mentioning 'a human ear grown on a mouse' was not only not related to genomics but also likely to evoke the so-called 'yuck factor' from respondents. Nonetheless, negotiations with the archivists convinced us that they felt strongly that its inclusion would encourage engagement with our topic. Similarly, moving topics from an overview to a list of prompts directed respondents differently than we had initially imagined and was part of learning about the specificities of the research instrument.

Full text of the directive:

> Part 1[1]: Genes, Genetics and Cloning
>
> Dolly the sheep, a human ear grown on a mouse, designer babies.....
>
> In 2000 the world heard about the near completion of the Human Genome Map as one of the most important scientific developments of all time. Since then, there have been developments in DNA testing and human cloning. Genetic testing has become widely available, and cures are promised from stem cell research.
>
> We would like to have your thoughts on:

[1] There were three parts to the spring directive. The second part sought to find out what respondents thought of public displays of mourning and grief. The third part asked them to write a one-day diary on a day of their choosing.

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- Genetic testing for inherited conditions
- Paternity testing
- Forensic testing and criminal investigations
- Research purposes

Please tell us about any direct experience that you have had of these scientific developments in the field of genetics. Include experiences of those around you - friends, family, neighbours, work mates and others.

Where do you get your information from on these issues? Please provide as much detail as possible.

Tell us about any films, television programmes, books or artworks that deal with these issues. What do you think of them?

What news coverage, issues or stories about genetics have interested you most, or you have thought most significant?

What do you think about the regulation of scientific research, and how it might impact on you and those around you?

What do you think are the most important issues around human genetics and cloning?

Handling the responses

The first outcome of the directive was the arrival of 222 responses over several months. *Mass Observation* staff sorted these out by detaching the Genes, Genetics and Cloning responses from the two other sections of the directive and by putting them into numerical order and storing them in four box files. Each respondent is assigned an archive number so that, although they are anonymised, it is possible to look at the same respondent's replies across different directives.

The responses were handwritten, typed or word-processed. The accumulation of a textual archive and dealing with the specific materiality of these texts including the type and shape of paper, the typeface or handwriting, and its legibility, are all features of the *Mass Observation* operation. We extracted these from their archive boxes and read them several times to get a

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feel for the responses and this reading experience gave us a strong sense of their materiality. This is an important dimension of the *Mass Observation* project and contributes to researcher and staff feelings that their archive constitutes a special collection. The sense of writing for and building an archive is also something felt by participants. There were comments about the significance of *Mass Observation* in the responses we solicited. For example, one contributor reflected: 'I have been a writer for many years and with Mass Observation for 15 years. (…) As I get older I want to record social history more.' (F218). [2]

Despite the importance of the materiality of the archive, we also decided to transcribe the directive results into electronic form. We did this for two reasons. We wanted to enable other colleagues researching social aspect of genomics to have access to the directive materials. Secondly, we felt translating the feedback into electronic data would enable diverse forms of interrogation of the whole corpus. Using qualitative data analysis software helped us to identify patterns in the digitised material that otherwise would have been difficult to discern.

Mass Observation of the media culture of genetics: a long timeline

Media Resources

The directive materials yielded a map of media references, including books or artworks, which gave us a sense of the kind of mediascape with which contributors were engaging as they responded. In the directive we specifically asked:

> 'Where do you get your information from on these issues? Please provide as much detail as possible. Tell us about any films, television programmes, books or artworks that deal with these issues. What do you think of them? What news coverage, issues or stories about genetics have interested you most, or you have thought most significant?'

In some instances people gave us lists of media, such as that provided in the account from a septuagenarian part-time teacher who suggested that "A good balance to Marx and religion is to use your common sense and see what really happens and who pays for and governs the research findings". Her media corpus is extremely extensive (headings used respondent's own):

[2] All quotes are identified by their MO number and can be found in the Genes Directive archive box, Mass Observation, The Keep.

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Media

Some off-centre publications are very interesting; Big Issue; The Freethinker; Abortion Rights; Connections (USA) – liberal RC. Another publication is the Times which is very freespoken these days; shades of W.T. STEAD. (…) 3

Science fiction and horror studies such as The Island of Dr Moreau; Animal –human mingling is coming true in a sort of a way. Likewise Species 1 and 11 and SSSSS Snake. (…)

Artworks

H.Bosch is an interesting painter; likewise some wall frescoes about Hell – Hell on church walls. Modern artworks seem either gross or trivial as Johnson said of some poems. They are not frightening but some chap's ego trip or nauseating. Waccy baccy anyone?

TV Programmes

Well, they have to be ever so careful not to offend minorities and not to further inform animal rights terrorists who have closed a guinea pig farm, dug up a corpse, chucked lots of research abroad e.g. to Poland. They have to be careful not to offend religious hatred bills and directives. They explain matters very well but it is hard to use bits in class. Fortunately even "X" girls can learn lots off the media including Satellites these days and I'm so glad. (A1292)

In some responses, no reference to media was made at all, in others, respondents did not actually name the media source. For example, one contributor mentioned a film in which a face transplant had occurred. From their synopsis we interpreted this to be a reference to the feature film *Face Off* (1997). This respondent was connecting a news item on an actual face transplant that had occurred during the time of the directive (2006) and the prefiguring of this in fictional film in 1997. In some instances it wasn't possible to identify a specific version of a text, although a clear general reference was made. For example, there were multiple references to *Brave New World* and *The Island of Dr Moreau*, both of which have appeared as novels, radio plays, films and television programmes. References were also made to figures which originated in a specific media text but which have subsequently appeared across a variety of media. These included: Nazi science; Dr Frankenstein; and cloned humans.

Mapping the timeline

[3] W.T Stead was a controversial British investigative journalist of the Victorian era. He promoted campaign style approaches to social reforms in relation to poverty, the age of consent, anti-slavery and pacifism. He was a controversial figure who was also heavily involved in spiritualism and who died in the sinking of the Titanic. (W.T. Stead Resource Centre)

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Even with these caveats, it was possible to plot references across a mediascape. We plotted these media references on a timeline, which ran from 1932 until late 2006. Our timeline is illustrated in Figure 1 and this can be viewed in much more detail online[4]. The timeline shows that there are significant media events or texts referenced repeatedly in our respondents' accounts. These include early 20th century texts, and clusters, that appeared in the late 1970s and early 1980s, as well as during the period the directive call was in operation.

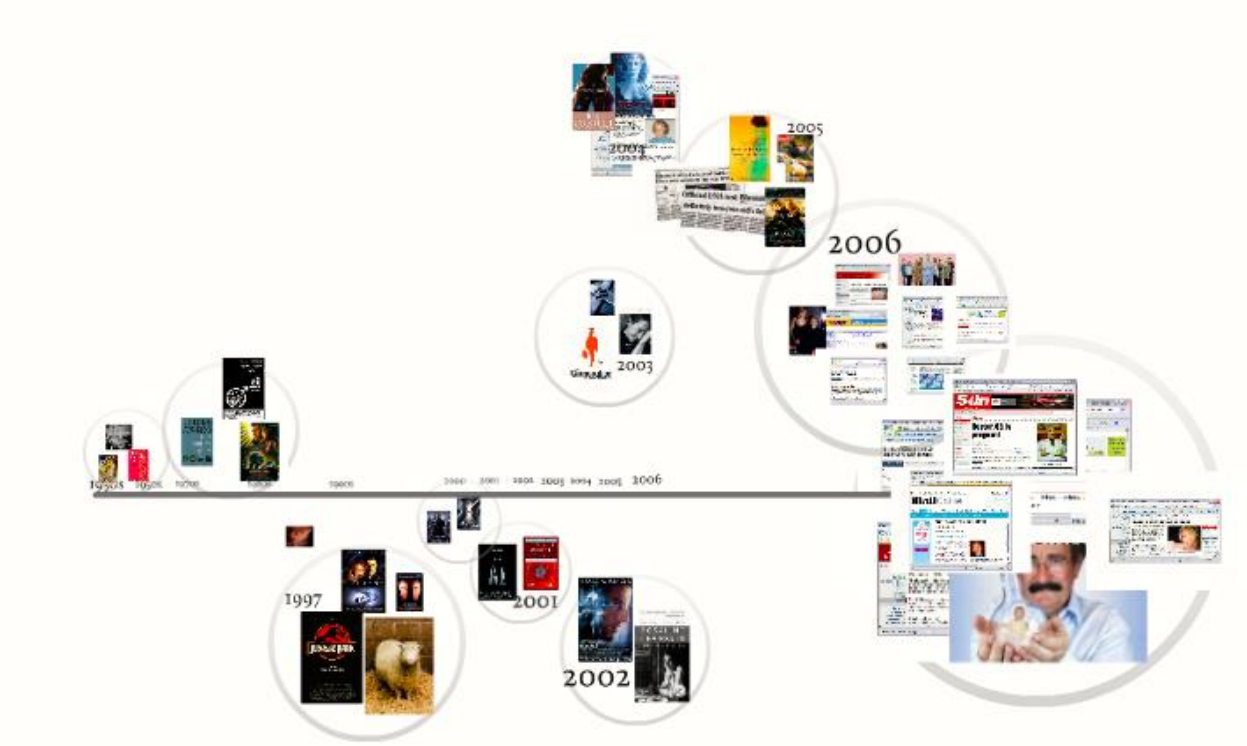

Figure 1: Timeline

Chronologically, the first media references are to the 1932 novel, *Brave New World* by Aldous Huxley. This is followed by references to Watson and Crick's announcement of the double helix structure of DNA in 1953 and to *The Double Helix*; the memoir of that discovery published by James Watson in 1968. The 1970s-80s cluster in the timeline includes the popular science book *The Selfish Gene* (1976) by Richard Dawkins; the feature film, the *Boys From Brazil* (1978) which was adapted from the 1976 novel of the same name and the iconic science fiction film *Blade Runner*, released in 1982. There is a gap in the time line with no citations of media sources from the early 1980s to the late 1990s. The numbers of references increase substantially for the following years. There were many texts cited from 2006, the year the

[4] *author removed*

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directive ran, so we have divided this year into two clusters in the timeline. A close-up of a cluster from 2005 is less dense and gives a fairly representative array of the kinds of resources that respondents were using.

Figure 2: Timeline close up of 2005

Media references from 2005-2006

This cluster shows a mixture of news stories, a novel and a film. *Never Let Me Go* by Ishiguro, a novel concerned with cloning, which was published in 2005 and made into a film in 2010 was referenced, as was the Hollywood action film *The Island* (2005). There were news stories about the UK politician David Blunkett with a DNA testing theme in 2005-6 and these caught the attention of some respondents:

> Paternity testing was big news recently when David Blunkett insisted his mistress' baby was tested to see if he was the father. The case highlighted the issue that there are biological fathers and social fathers: sometimes they coincide, but sometimes they don't. (F3137)

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Respondents citing mixtures of books, films and news (as providing information on cloning and genomics) is a feature of the longitudinal media cultures that come into focus from the directive responses.

When we look at the citations from 2006, the year of the directive, news comes to the fore with direct references to twenty different news media and documentary sources, and to one fictional television drama (*The Family Man*). The prominence of references to recent news coverage aligns with research which understands the news media as figuring in terms of its immediacy. However, it is also clear from this timeline that participants are referencing a history of media representations that inform the reception of news in 2006. This shows us the diversity and long-term impact of science media sources that contribute to public knowledge around human and animal of cloning and genetics. For example, the instance above when the face transplant news was linked to the film a decade earlier, or when mentions of Nazi science are contrasted with contemporary UK science as in the dispositions discussion below.

Dispositions towards Genes, Genetics and Cloning

The MO directive wasn't specifically designed to elicit attitudes towards genomics but a strong sense of these came through. We had asked respondents for their thoughts on genetic testing for inherited conditions, paternity testing, forensic testing and criminal investigations or research purposes. We coded the responses for clear support or antipathy expressed towards each of these practices by respondents, for expressions of ambivalence and for no references made to the practices. Our findings indicated that when understood as contributing to scientific or medical progress genetic science was generally regarded favourably. Nevertheless this was tempered by expressions of some ambivalence; suspicion of individual scientists; and misgivings about cloning. Some respondents voiced pragmatic recognition of the unintended consequences of science, with this respondent alluding and dismissing a more dystopian framing:

> As for the no good will come of it, I'm sure there will be at least some negative outcomes; even if only as a result of the vast number of centenarians on the roads. However, three steps forward and two back is still progress; and surely genetic engineering is our next step in medical progress. (C3092)

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Large-scale public attitude and disposition research into science has been conducted since at least the mid 20th century (Withey,1959). Public attitudes to genetics, genomics and cloning have been systematically surveyed through multiple instruments such as Eurobarometer, ELSI work, and through the PR, education and engagement activities of biomedicine and industry since the 1980s. This research shows some trends such as a slight correlation between knowledge about a specific area of science and general approval, although these have notable exceptions such as GM crops and foods (and more dramatically in other areas such as nuclear power where more knowledge and more approval do not correlate). In relation to genetics there have been consistent findings that attitudes have become more positive since the 1950s, that these are dynamic and contextual, and that since the 1980s forensic and medical testing meets with broad approval, and that cloning does not (Condit 2010, Etchegary 2014).

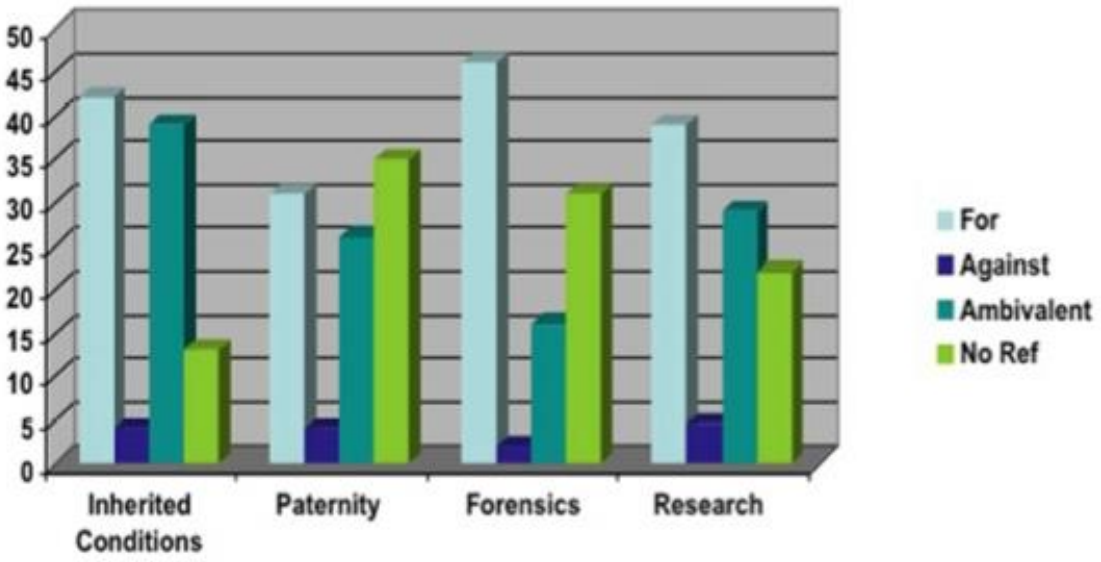

Figure 3: Dispositions (general attitudes)

Figure 3: Dispositions chart (general attitudes inferred from statements made in MO responses)

Figure 3 illustrates what we infer about MO respondents' attitudes as they were not asked to give explicit binary or scalar responses to closed questions. The relative distribution of attitudes cannot be taken to be representative of the UK population as a whole, but we would argue that

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they are suggestive because of their similarities to the quantitative studies previously mentioned. For example, confirming Condit's survey (2010), there was clear, unambiguous approval for the use of genetic testing in criminal detection from 45% of the MO respondents who stated that they were in favour of this application. It also had a relatively high level of mention with around 70% of respondents referring directly to this topic. However, what was of interest to us was the ways in which respondents accounted for their positive, negative or ambivalent thoughts and feelings about the issues and practices listed in the directive (inherited conditions, paternity, crime and research).

Our respondents reported limited direct experience of issues connected to genes, genetics and cloning. Frequency of mention and experience didn't correspond. For example, although there were 60 mentions of DNA and policing and very few people thought this area controversial, the register of experience of this was very low. With the exception of three people – one arrestee; a social worker; and a police officer – everyone else referred to television or print news and drama when writing about this field of practice. In the following account the respondent describes work in this field:

> Because of my job, I don't really think of DNA testing as anything out of the ordinary its become second nature. I know its only been around for the last 20 or 30 years or so but to me I've never known anything different, its always been there. DNA testing is a powerful tool, it helps identify offenders and its amazing where you can get the DNA from. We collect it from fag butts, cups and we can even get a trace from sweat particles. Its great stuff. (P3373)

The issue mentioned most frequently was testing for inherited conditions, with just under 90% mentioning this. We think that two factors contribute to the high frequency of references to inherited conditions. One is that it was mentioned first in the list of issues to which we asked people to respond so this acted as the first prompt and, second, of all the issues mentioned it was the one was most frequently linked to personal experience. (Although 'high' in this context entailed just under 20% of respondents.)

> As the Grandmother of a child who has 50% chance of having inherited the gene for Huntingdon's disease I am in favour of testing for inherited conditions.(…) Should my grand daughter go on to develop the symptoms of Huntingdon's would that make us love her less? Could we imagine our lives without her in it? Was it selfish of her parents to have her knowing

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> that she might inherit the gene? The answer to these and many other questions for us is of course a resounding 'no'. (P3392)

The frequency of reports of direct experience of genetic testing for research purposes and paternity was very low. However, people still felt able to discuss and evaluate these practices even when they seemed to be denying their own reflections:

> I haven't any thoughts on paternity testing – who wants it, and what for? Seems like another stick to beat a wife or male parent with. (R1760)

Ways of knowing and public engagement

Mediating 'Real Thoughts and Opinions'

Although we wanted respondents to frame their own accounts of their knowledge of genes, genetics and cloning, we were concerned that the directive as it was eventually circulated was overly framing. This was suggested in the comments of one respondent who reflected on their responses to both our directive and to the one on public mourning in the same call, referring to their perception of the rationale of *Mass Observation*:

> I have struggled with replying to the two above mentioned topics as I feel they represent a divergence from the original *Mass Observation* aims and ideals. I have always believed the original members who set up this organisation in the late 1930's wanted to understand the real thoughts and opinions of people throughout the country and from all walks of life, free of external influence or interference.
>
> This seems to conflict with the much more commonly commissioned subject matter that is now appearing more and more in each Directive. I can't help but object to voluntarily giving my opinion, if that opinion is likely to become part of a piece of work wither *(sic)* commissioned by an academic or subsequently used for profit in an author's published work, I don't object to researchers using M.O. views as retrospective, research tool in their work, but I do object to being asked to comment on a subject which an individual chooses beforehand. It appears to me there is now a change of emphasis that was not apparent when I first became a participant and which I don't altogether agree with. (S2581)

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This indicates a concern with instrumental research and the commodification of publics as consumer instruments offering a distinction between civic and market publics. This respondent was not alone in offering a self-reflexive response to the directive and in tackling broader questions of knowledge and understanding. The responses taken as a whole were varied and demonstrated a range of understandings of scientific knowledge and scientific knowledge production. They also produced hierarchies of distinction between knowledges deriving from fact and fiction and there was considerable evidence of deference to expert knowledge: 'I feel that I still do not have enough scientific knowledge to fully comprehend the effects and consequences of this matter' (H2639)

Some accounts included what could be characterised as an assertive lack of interest -- what Mike Michaels has called a 'discourse of ignorance' (Michaels 1996) -- in the topics of genes, genetics and cloning. Instead of querying the directive, as was done in the comment quoted above, they displayed their resistance to responding. However, these responses nonetheless registered both the significance of these technoscientific fields and awareness of and compliance with dominant discourses concerning cures and cloning, as in the following:

> I am totally bored by this subject so that the amount I shall write will be very little. It is sufficient to note that if genetic engineering helps to prevent and alleviate inherited medical conditions then I fully support such endeavours. If it is to meddle with nature in order to produce clones then I am not in favour. The bald fact is that I know virtually nothing about the subject and feel unable to write anything worthwhile about it. Whenever the subject appears in the press (there have been a few references to genetic engineering in 'The Times') I quickly move on to another page in search of something more interesting. (W3176)

In his 1996 essay, Michael suggests four potential discourses of ignorance: unconstructed absence, 'Ignorance' and mental constitution, 'Ignorance' and the division of labour, 'Ignorance' as a deliberate choice. In the response above only the first of these discourses does not apply. The respondent is aware that the topic is one on which they might be expected to hold an opinion because it comes up in 'The Times', presumably their newspaper of choice, but they deliberately choose not to remedy their ignorance because they find the subject boring. Further, they suggest that they are 'constitutionally not mentally equipped to fathom the mysteries of science – whether those be the domain of professional scientists or the domain of members of a public "scientific culture"' (Michael 1996: 117). However, they are content to support those working to prevent or alleviate inherited medical conditions so they presumably have faith in the

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expertise of these scientists and are content to leave concern about this domain of science to them.

Genetic knowledge and the role of scientists

Although the text of the directive did not mention scientists *per se*, referring only to scientific developments, about a third of the respondents introduced the term 'scientist' or 'scientists' in their responses. This shows how the respondents writing practices constitute materials in the process of making knowledge, in this instance through generating their own figures, protagonists and actors in making knowledge. They introduced scientists as actors in the field and they represented them as subject to structural pressures similar to those experienced by workers in other fields. The development of the field of genomics was framed in this context. In some cases, the term was introduced in reports of news stories about something that scientists had done. Where the term was introduced to make judgements about scientists only seven respondents made explicitly negative judgements or expressed lack of trust. Twelve respondents were exclusively positive, while 34 were ambivalent. This latter group weighed the benefits of scientists' work against the risks involved, including scientific developments outpacing regulation and the potential for rogue or maverick scientists. The remaining references were primarily descriptive, rather than evaluative, expressing neither positivity, negativity nor ambivalence.

Respondents expressed both wonder and hope about the possibilities of treatments and cures. For example, one offered the comment: "The human body for scientists is a pandora's box of secrets to help them discover new treatments and cures for other suffering human beings. I find this amazing! And who am I to judge scientists, doctors etc who are helping people in unimaginable sufferings" (F3592). Some expressed concern about other kinds of publics and indicated that knee-jerk judgements may be made based on historical or religious concerns: "Many are against this area mainly I think from a religious point of view, however when you look into this area, like stem cell research, the scientists involved in cloning are doing it for the medical benefits rather than trying to make a perfect race as the Germans did during the war." (B3750). However, even respondents positively disposed to scientists and research drew attention to risk and to the need for regulation, although there was some disparity about the form they imagined this regulation would take. One respondent offered an explicit acknowledgement that scientists were vulnerable to criticism – and made reference to the differences of opinion that arise in a democracy – whilst validating their work: "Can there be any

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criticism of those scientists who wish to make new discoveries that could transform lives and give hope? Even to this question to which my reply would be an obvious 'no' I can appreciate the argument against" (P3209).

A small number of respondents were very clearly negative about and distrustful of scientists, and expressed this negativity using tropes relating to the hubristic pursuit of knowledge. For example, one claimed: "As for research, the word fills me with dread instead of hope because I have the gut feeling that scientists are on the whole dangerous people who never know when to stop." (D996), while another said "I really don't trust the scientists playing God and I would like them to be stopped mucking about with such things." (C3006). The latter statement was made after the respondent referred to the possibility of a deadly escape of a genetically engineered pathogen. The same respondent later mentioned mavericks pushing boundaries and framed genomics implicitly as a latter day eugenics through a reference to Adolf Hitler. This respondent's anxiety echoes mainstream critiques regarding the governance of risk, even if the frame 'scientists playing God' might be imagined to connote a knee-jerk anti-science position.

Where ambivalence was expressed, this sometimes took the form of balancing approval for the advances made by (the right kind of) scientists with the risks posed by rogue, maverick or unethical scientists. Ambivalence was also frequently manifested in relation to structural factors such as commercial pressure, competition, or the ambition to push the frontiers of knowledge the risks attendant to these pressures. One respondent speculated about the ethics of cloning and stem cell research and remarked that: "I've no doubt there are ethicists debating these and related issues, but do the scientists actually carrying out the research ask these questions – particularly when, as must sometimes be the case, they're working for private companies who are only in this line of work for the profits?" (M3190). Our respondents often registered ambivalence about scientists and their endeavours in the genetic field, but, as is clear from the archive material, such ambivalence constitutes a careful and thoughtful mode of engagement.

Public knowledge and governance

Since the 1980s, and the constitution of the field of Public Understanding of Science (Durant, Evans, Thomas, 1989; McNeil, 2013) scientists and policymakers have shifted perspectives and moved from the language of 'public understanding of' to 'public engagement with' science. This entails a more active agential framing of the public, and this often explicitly acknowledges the important role of the media in such 'public engagement' with science (Turney, 2006).

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Nevertheless, this reorientation (as Alan Irwin amongst others has noted) often seems to revolve around securing science's 'licence to practise', rather than moderating, regulating or restricting it (Irwin 2006: 308). Scientists in the field of human genomics have taken particular heed of the calls to engage publics. The Wellcome Trust alone has funded over two decades of public engagement through its sci:art, media and educational engagement programmes, much of which has been dedicated to genetics and genomics. Scientists and institutions have attempted to influence governance in the direction of securing their licence to practise through proactive media relations, which are framed as both providing the public with the resources they need to form rational opinions about science, and as a stand in for public opinion (Haran 2013).

In the responses received to the directive, there was much evidence of concern with media as a source of scientific information and as generating concerns about governance. Some of the respondents expressed their concern that the media misrepresented scientific research causing unnecessary alarm and undue concern about scientists' behaviour (cf the response above from C3006):

> I think that reports in the media can often give a false impression of what genetic research is about, making it sound horrific and frightening. Newspaper reports often give the impression that scientists are trying to produce a creature which is half human and half cow, or that they are experimenting on young babies, or engaging in similar horrific activity. There is a great deal of difference between an embryo and a baby, and no one is planning to produce a fully grown human-animal hybrid, but the impression given in some news reports may suggest otherwise and this can give unnecessary cause for concern. (A2212).

However, this same respondent acknowledged:

> I have not had any direct personal experience of these scientific developments and I do not know of anyone who has. I have gained what little knowledge I have about any of this from newspaper reports and documentaries on television, but I do not remember any article or programmes in particular, and I am not aware of any books, films or artworks relating to these issues. I am not particularly interested in genetics, and am not aware of any specific stories or issues about genetics (A2212)

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Nonetheless, this correspondent wrote detailed lengthy paragraphs using exemplary scenarios to justify what they thought about each of the scientific developments mentioned in the Directive including the one are of genetics that had caused them concern: 'the genetic engineering of crops and the growing of these crops in the open, where they can contaminate the environment. I think that this practice has been commercially driven without sufficient consideration of the risks' (A2212). So it is curious that despite their demonstrable sophisticated critical literacy with regard to media representations of genetics, and strong opinions on risk management that they express concern about other media users' capacity to weigh media representations appropriately.

Another respondent (75 years old when the response was filed), remarked:

> I fully understand the concern of people about cloning, and whether this could lead to "mad scientists" attempting to breed a super human. Many of my age are aware of the Nazi ideals of breeding such a generation, and the vile experiments carried out at Auschwitz by Dr Mengele and his team. The public are quite right in seeking strict controls of what is or is not permissible (S2083)

These two respondents' opinions taken together illustrate the tension between the concern that the media misrepresent science, making it more horrifying, on the one hand and the concern that unacceptable practices in the sciences might go unscrutinised without media intervention on the other. Although the respondent quoted above was the only one who mentioned Nazis explicitly, the reason that many of his generation knew about these experiments was because of cinema newsreels that were shown in the UK following the liberation of the concentration camps at the close of WWII (Michalczyk, 2014). They also highlight an opposition between government and elites on the one side and publics on the other, locating the more relevant political agency in the public who are aligned here with being 'quite right in seeking strict control'. So when rhetorical claims are made that impute the public's fears about cloning to a 'false impression' through their viewing of horror or science fiction such as *The Boys from Brazil* it is important to register that this novel (and subsequent film) articulated already-existing concerns rather than provoking new ones. This is to say that fictional horror tropes in the later 20th Century reference ideas from news reporting and historical materials from the 1940s and 1950s; the fictional trope becomes a shorthand for historically-grounded fears. The MO discussions as a whole suggest that much public knowledge-making about genetics occurs primarily through an historical sense of media engagement and that forms of critical media

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reading, including the negotiation of multiple genres and framings are crucial. Far from projecting a horrified public who are against science or genetics, the engagement (here and in other research) is ambivalent, thoughtful and generally positive.

A number of respondents indicated that they were confident both about the type of research being conducted and its mode of governance, linking their confidence to a national sense of the science and governance practiced in the UK. One respondent asserted: "I welcome stem cell research and do not have any qualms about the use of stem cells by responsible scientists sticking to a code of practice determine by people from all sides of the ethical debate" (T1843). However, she went on to suggest that her concerns lay with the advances that might emerge from military research and that: "Any new biotechnology in the wrong hands needs global regulation in monitoring or, as in radium and the splitting of the atom or in biological or chemical warfare, we are all at risk once again".

One middle-aged female respondent observed that she got most of her information about genes, genetics and cloning "from newspapers (usually Sunday ones) or TV". She pointed out that she didn't read anything with cloning or genetic mutation as their themes because she wasn't really into fantasy or sci-fi books:

> I think scientific research is a good thing, to help people with lots of illnesses but I think genetics and cloning has to be careful in what it does – I think it would be early for techniques to go too far as to get into the wrong scientists' hands, and be abused. I think ultimately the government or bodies who (word illegible) these issues are quite cautious, but sensible, and so far have not allowed (illegible) least what little I know, things to get out of hand. (W729)

In their explicit parsing of their knowledge of genes, genetics and cloning, many respondents, like the one cited above, were careful to point out what they didn't count as knowledge or as a resource for knowledge production. They talked about the issue of misinformation with reference to both fictional and factual media:

> I'm interested in how things are reported because they often scare monger or misinform. The most significant story of late was the Human Genome. Other stories which are given less news coverage, could potentially have more impact on humans e.g. the cloning of the Plasmodium falciparum (malaria parasite). (M3584)

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A number of respondents also disavowed the influence of religion and of their feelings, frequently suggesting that these influences did have impacts on them, which they resisted. This indicates alignment with what Sheila Jasanoff refers to as civic epistemology about science (Jasanoff, 2011). Such formulations are consistent with what we have suggested elsewhere is the ideal UK citizen or member of the public - a person who adheres to a nationally rooted secular rationality (Haran *et al* 2008).

Conclusion and future directions: public knowledge making

Media analysis of science communication often focuses on particular media forms, by tracking specific topics in science news (Kitzinger 2008, Nerlich et al 2002), or identifying the features of science presented in the cinema (Kirby 2011, Stacey 2010). There is also a tendency to prioritise specific genres, and television drama and radio (for example) rarely get much attention. Part of our interest in the MO was that it potentially provided a more accessible way of studying a wide range of media uses and influences. Moreover, the mediascape brought into focus by our respondents couldn't have been captured through media specific approaches. Our findings demonstrate that respondents related to a wide range of media across different temporalities, including a diverse range of genres in visions of a broad media culture rather than considering them individually. Having evidence to substantiate this and tracing it through multiple responses was one of the benefits of the working with the kind of accounts produced by MO. It might seem straightforward to claim that people draw on a mix of media genres over time, but much analysis of science media is conducted as if specific genres (mainly news) act in isolation from other media forms, and in relation to an immediate temporality. Bringing this long mediascape out of the MO and to the attention of scholars in science media, public understanding of science and elsewhere is an important outcome of this research.

Writing about "Science and Public Participation", Bucchi and Neresini (2008) point out that "the distinction between expert and lay knowledge cannot be reduced to a mere information gap between experts and the general public as envisioned by the deficit model. Lay knowledge is not an impoverished or quantitatively inferior version of expert knowledge; it is qualitatively different."(451) They go on to characterise this difference as follows: "Factual information is only one ingredient of lay knowledge, in which it interweaves with other elements (value judgements, trust in the scientific institutions, the person's perception of his or her ability to put scientific knowledge to practical use) to form a corpus no less sophisticated than specialist expertise" (loc.cit).

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The MO directive responses amply bear out Bucchi and Neresini's characterisation of the interwoven quality of lay knowledge. Respondents drew on limited instances of personal experience, for example, one respondent referred to her personal experience of in vitro fertilisation, while another mentioned that she was an egg donor. They also drew on their analysis of social and economic dynamics and relationships, indicating understandings of scientists as subject to the constraints of competition and the market, as well as personal or institutional ambitions. Some revealed insecurities about the soundness of their knowledge because of their recognition that their media sources were fictional or that factual genres are the business of selling newspapers or airtime, rather than in the business of undertaking science communication for its own sake. Some voiced confidence in the governance arrangements in the UK and some were vocal in their arguments that these arrangements needed to facilitate public contribution to the discussion of what lines of scientific research should be undertaken. Some also suggested that governance in a global context was problematic and difficult.

In terms of the media resources drawn upon in respondents' representations of genes, genetics and cloning, we have described how these cluster around particular historical moments. The frequency of references to news coverage at the time of the directive itself, demonstrate that respondents drew links between what they understood as related areas of science across time and media formats. They evaluated media news sources as very different from novels and films, as resources for information and knowledge about genetic science and cloning. Nevertheless, novels, films and news stories emerging over a 74-year time line were interwoven and layered as resources in respondents' representations of these fields of science in the present, thus producing evidence of a mixed genre, longitudinal media culture of genetics and genomics.

Despite claims that the late twentieth and early twenty-first century had brought a genomic revolution or marked the beginning of a genetic era, there was little evidence of this amongst our respondents. Our analysis of the MO directive gave us instead a sense of the layers and mixed temporality of a genetic/genomic media culture unfolding over the 20th Century. The directive provided detailed, nuanced and materially embedded responses, which add to an understanding of the resourcing of public-knowledge making about science. Indications of resistance to the directive, as well as resistance to genomics provide some insights into what might be thought of as uninvited or deliberately ignorant publics and different kinds of agency.

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Hence, this investigation constitutes an important intervention in linking media specific studies of audiences with the ethnographic analysis of public engagement activities.

As noted previously the directive went out at the cusp of crucial changes in the media environment, just before the advent of mass use of social media, and also therefore prior to the emergence of on-line genetic testing. On-line testing and personal genome sequencing have been heralded as the next wave in the genetics revolution however, it is important to note that on-line testing is only a change of platform. Direct to consumer genetic testing had already been established through the *Genographic Project*, and other media orientated ancestry-testing projects that combined TV production with genomic research. Nonetheless, the imbrication of social media in the new consumer testing products would likely add another layer to the media culture of at least some MO respondents were we to reissue the directive ten years later. Further, Twitter – whose stated mission is 'to give everyone the power to create and share ideas and information instantly, without barriers' was launched roughly concurrently with our MO directive and in the intervening ten years has been used extensively by academics, corporations, and pressure groups working in the field of genomics to disseminate information and critique rapidly and globally. In the light of such developments it is tempting to speculate that further investigation might yield more extensive evidence of direct experience of genomics and of some shifts in the range of media resources, although we suspect that MO respondents would still articulate their knowledge claims in a multi-layered fashion.

It would also be desirable to follow-up the directive since the establishment of Genomics England in the UK, and in the light of public discussions about genetic editing technologies (such as CRISPR) to investigate whether respondents' views on governance might have changed. However, against this, it is important to note that the making of genetics as the celebrity science of biology, and the promise that genomics will transform lives has also been repeated over time. It is also important to register that those epochs marked as different – the new genetics of the 1950s, the genome project of the 1980s and 1990s, and the genomics of the 21st century - are not marked as distinct in respondents' personal media cultures of genomics. People connect cultural production through the 20th and 21st century in ways that make sense to them. However, in the ten years since the publication of our directive, UK citizens have witnessed scandals that have negatively impacted trust in both politicians and journalists so it would be interesting to explore the extent to which this would combine with the potential that social media provides for members of the public to feel more agentic in knowledge

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production. How differently might respondents to a similar MO Directive in 2016 account for their knowledge about genes, genetics and cloning?

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